Claims

1. A fuel injection valve for fuel injection systems of combustion engines, in particular for the direct injection of fuel into a combustion chamber of a combustion engine, comprising
- a fuel inlet (12) which is adapted to have fuel flow into the fuel injection valve,
- an electrically controllable actuation means (24) which cooperates with a valve arrangement (20) in order to cause the fuel in a directly or indirectly controlled manner to exit into the combustion chamber through a fuel outlet (18), with
-- the actuation means (24) comprising a magnet coil arrangement (24a) to be supplied with current, an essentially soft magnetic magnet yoke arrangement (24b) cooperating with same, as well as an essentially soft magnetic magnet armature (24c) arrangement cooperating with same,
characterised in that
- the magnet yoke arrangement (24b) comprises several pole lands (25a, 25b) which are at least partially surrounded by electromagnet coil arrangements (24a', 24a") which are adapted to guide a reverse electrical current each at opposite flanks (25a', 25a") of the pole lands (25a, 25b).

2. The fuel injection valve according to Claim 1, characterised in that
- the pole lands (25a, 25b) comprise a pitch dimension which is 2 to 30 times, preferably 5 to 20 times, and particularly preferably approximately 10 times larger than an air gap formed between the magnet yoke arrangement (24b) and the magnet armature arrangement (24c) in a rest position of the actuation means (24).

3. The fuel injection valve according to Claim 1 or 2, characterised in that
- the pole lands (25a, 25b) have an essentially asymmetric configuration with respect to the centre longitudinal axis (M) of the fuel injection valve.

4. The fuel injection valve according to one of Claims 1 to 3, characterised in that
- the pole lands (25a, 25b) have a helical configuration with respect to the centre longitudinal axis (M) of the fuel injection valve.

5. The fuel injection valve according to one of Claims 1 to 4, characterised in that
- a current conducting band and a sheet metal band containing soft iron are arranged between two layers of sheet metal containing soft iron with the current conducting band and the sheet metal band containing soft iron adjoining at one longitudinal edge each.

6. The fuel injection valve according to one of Claims 1 to 5, characterised in that

- the pole lands (25a, 25b) have an essentially polygonal, preferably quadrangular shape and are arranged adjacent to one another under the formation of spaces for accommodating the electromagnet coil arrangements (24a', 24a"), with the pole lands (25a, 25b) being preferably arranged parallel to one another.

7. The fuel injection valve according to one of Claims 1 to 6, characterised in that
- at least two neighbouring pole lands (25a, 25b) are surrounded by at least one electromagnet coil arrangement (24a', 24a") at least partially in meander fashion.

8. The fuel injection valve according to one of Claims 1 to 6, characterised in that
- one pole land (25a, 25b) each is at least partially surrounded by at least one electromagnet coil arrangement (24a', 24a").

9. The fuel injection valve according to one of Claims 1 to 8, characterised in that
- at least one electromagnet coil arrangement (24a', 24a") encloses non-circular pole lands (25a, 25b) at least partially.

10. The fuel injection valve according to one of Claims 1 to 9, characterised in that
- the actuation means (24) comprises more than one assembly, formed by the magnet coil arrangement (24a), the magnet yoke arrangement (24b), and the magnet armature arrangement (24c), with these assemblies acting collectively on the valve arrangement (20) either in the same sense or in opposite senses.

11. The fuel injection valve according to one of Claims 1 to 10, characterised in that
- the actuation means (24) acts on a movable valve member (20a) of the valve arrangement (20) in order to move it relative to a stationary valve seat (20b) which cooperates with the valve member (20a) and is arranged downstream of the fuel inlet (12) between an open position and a closed position.

12. The fuel injection valve according to one of the previous claims, characterised in that
- the soft magnetic magnet yoke arrangement (24b) comprises at least two joined dish parts (24b', 24b") with recesses (26a, 26b) in which one electromagnet coil arrangement (24a', 24a") each is accommodated, which terminates essentially flush with the respective face (27a, 27b) of one of the dish parts (24b', 24b"), with the faces (27a, 27b) together defining a cavity (28) in which the magnet armature arrangement (24c) is accommodated so as to be movable along the centre longitudinal axis (M).

13. The fuel injection valve according to one of the previous claims, characterised in that

- the electromagnet coil arrangement (24a', 24a") is formed at least on one side of the soft magnetic magnet armature arrangement (24c) by several electromagnet coil arrangements which terminate essentially flush with one of the faces (27a, 27b) of one of the dish halves (24b', 24b").

14. The fuel injection valve according to one of the previous claims, characterised in that
- the individual coils have a thickness of approx. 20 to approx. 80% of the magnet yoke iron located between two coils.

15. The fuel injection valve according to one of the previous claims, characterised in that
- the individual coils on one side of the soft magnetic magnet armature arrangement (24c) are adapted to be supplied with reverse current.

16. The fuel injection valve according to one of the previous claims, characterised in that
- the yoke iron is formed by iron plates which are insulated against one another between the individual coils on one side of the soft magnetic magnet armature arrangement (24c).

17. The fuel injection valve according to one of the previous claims, characterised in that
- the electromagnet coil arrangement (24a) and the magnet armature arrangement (24c) are oriented essentially under right angles relative to one another.

18. The fuel injection valve according to one of the previous claims, characterised in that
- the magnet coil arrangement (24a) and the magnet armature arrangement (24c) overlap at least partially in a radial direction relative to the centre longitudinal axis (M).

19. The fuel injection valve according to one of the previous claims, characterised in that
- the magnet yoke arrangement (24b) is configured as an essentially cylindrical soft magnetic disk body with radially oriented gaps (36).

20. The fuel injection valve according to one of the previous claims, characterised in that
- the magnet armature arrangement is formed by two or more strip-shaped portions (25) which are spatially separated from each other.

21. The fuel injection valve according to one of the previous claims, characterised in that
- the magnet armature arrangement (24c) is configured as a soft magnetic disk with recesses (38), preferably slots or elongated holes which are radially oriented and extend to the edge (30) of the disk.

22. The fuel injection valve according to one of the previous claims, characterised in that
- the magnet armature arrangement (24c) is formed as a multilayer construction, with a ceramic layer (24c") being arranged between two soft iron layers (24c') and secured at the valve rod (22).

23. The fuel injection valve according to one of the previous claims, characterised in that
- the magnet armature arrangement (24c) and the valve member (20a) are connected with each other and are biased by a spring arrangement (40) into the open position or the closed position and can be brought into the closed position or the open position by current supply of the magnet coil arrangement (24a).

24. The fuel injection valve according to one of the previous claims, characterised in that
- the fuel injection valve is adapted and dimensioned to protrude into the combustion chamber of a combustion engine with externally supplied ignition.

25. The fuel injection valve according to one of Claims 1 to 14, characterised in that
- the fuel injection valve is adapted and dimensioned to protrude into the combustion chamber of a combustion engine with self-ignition.